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Alleviating Transitory Food Crisis in Africa

International Altruism and Trade

Victor Lavy

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This paper — a product of the Welfare and Human Resources Division, Population and Human Resources Department — was written under the auspices of the African Food Security Unit of the World Bank, as a background paper to the Bank's study, *Food Aid in Sub-Saharan Africa*. Copies of this paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Angela Murphy, room S9-114, extension 33750 (25 pages).

Lavy compared the role of food aid and commercial food imports in offsetting food "shocks" and covering the shortfall in food consumption in 26 countries in Sub-Saharan Africa.

Food aid to low-income countries with transitory or chronic food insecurity has been criticized on the grounds that:

- The international response to food crises is slow, meager, and inefficient.
- Food aid is discriminatory, depending on the recipient country's political and economic orientation.
- Food aid discourages domestic food production and encourages dependence on donors.
- Food aid depresses commercial imports of food, reducing the amount of food available.
- By alleviating shortages food aid allows countries to postpone or cancel politically costly economic reform.

But Lavy found that:

Food aid and commercial food imports stabilize food consumption and neutralize the effects of random shocks to domestic food production. Food aid compensates for up to half of the drop in food production; imports make up an additional 30 percent.

In other words, every one-ton drop in cereal production is offset by the delivery of 0.8 tons of cereal and dairy products from abroad. There is a lag in this response over a four-year period, but most of the aid is received in one to two years.

Surprisingly, the pattern of aid flows provides no evidence of discrimination by donors. Countries classified as socialist with military governments, and countries that do not protect human or political rights, receive an equal amount of aid during acute food shortages.

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Alleviating Transitory Food Crisis in Africa: International Altruism and Trade

by
Victor Lavy*

Table of Contents

* This paper was written under the auspices of the African Food Security Unit of the World Bank, as a background paper to the *Food aid in Sub-Saharan Africa* study. I would like to thank Shlomo Reutlinger for his assistance and useful insight and comments on the paper. I would also like to thank the World Bank Research Committee for financial support.

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Alleviating Transitory Food Crises in Africa: International Altruism and Trade

Food aid has long been used as an instrument to help low-income countries sustain domestic food supplies and cope with transitory or chronic food insecurity. It was also used with the intentions of accelerating agricultural development and increasing food production. But food aid has been heavily criticized in the last decade on the following grounds:

- The international response to food crises is slow, meager, and inefficient. (A related accusation suggests that emergency food aid is discriminatory, and depends on the political and economic orientation of the recipient country.)
- Food aid is a disincentive for domestic food production and leads to long term dependence on donors.
- Food aid depresses commercial imports of food, reducing overall food availability.
- By alleviating shortages food aid enables countries to postpone or even cancel politically costly economic reforms. These issues are discussed in the literature on food aid (see Stevens 1979; Singer and others 1987; Hopkins 1984; Wallerstein 1980; Bhagwati 1986; Srinivasan 1989; and Lavy 1990).

This paper focuses on criticism about the use of emergency food aid in Sub-Saharan Africa. More specifically, it examines the response of the donor community to unexpected or transitory drops in domestic food production in 26 countries. The study compares the role of food aid and commercial food imports

in offsetting these shocks and covering the shortfall in food consumption. Finally, I test several hypotheses that postulate the factors that determine the tendency of donors to respond to the needs of different countries. The study uses data for 1979-87, a period with fairly reliable figures on emergency food aid flows and agricultural production.

The results suggest that food aid and commercial food imports stabilize food consumption and neutralize the effects of random shocks to domestic production. Food aid compensates for up to 50 percent of the drop in food production; imports make up an additional 30 percent. In other words, every one-ton drop in cereal production is offset by the delivery of 0.8 tons of cereal and dairy products from abroad. There is, however, a lag in this response over a four-year period, although most of the aid is received in one to two years.

The results with regard to the accusation that emergency food aid is discriminatory are quite surprising. The international response to food crises in Sub-Saharan Africa is not contingent on the form of government or the level of political and human rights violations. On the contrary, countries classified as socialist with military governments, and that have a low score in terms of protecting political, economic, and civil liberties, tend to receive more aid in emergencies.

The paper is organized as follows: The first section documents the stylized facts of food insecurity in Africa and shows the relative importance of emergency and total food aid to food production and food shortages. Section 2 suggests an empirical framework for the estimation and analysis of the correlation between food aid and food production; the results are presented in Section 3. The final section elaborates on the economic and political

determinants that affect the global response to the emergency needs of countries in Africa.

I. TRANSITORY FOOD INSECURITY: THE STYLIZED FACTS

Unexpected transitory reductions in food production can have a dramatic effect on food consumption. Several mechanisms are available to stabilize food consumption, including commercial food supplies and emergency imports of food aid. Both options have been used to stabilize food consumption in Sub-Saharan Africa, where food supplies have been unstable over the last decade.

Table 1 summarizes the coefficients of variation (net of trend) of cereal food production averaged over 1970-87. The countries of the Sahel (Mauritania, Mali, Burkina Faso, Niger, Sudan, Ethiopia, and Somalia) had the largest annual fluctuations, followed by Botswana, Madagascar, and Tanzania. Note that the variability in the latter years is much higher, reflecting the 1983-85 drought. Output for even the most stable food producers in Africa fluctuates more sharply than in most other developing countries.[1]

The variability of cereal production parallels a declining trend in per capita cereal production. Table 2 summarizes annual growth rates for grain production and population from 1970 to 1982. East and West Africa had the highest rates of population growth and the lowest rates of cereal production growth. As a result per capita cereal production declined by -2.2 and -0.8 percent a year in East and West Africa respectively. Cereal production was up 1.8 percent in East Asia and the Pacific Rim, and 1.6 percent in the industrial economies, however.

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[1]"The Challenge of Hunger in Africa: A Call to Action." 1988. World Bank, Washington D.C.

TABLE 1: EMERGENCY AND REGULAR FOOD AID, COMMERCIAL FOOD IMPORTS, AND VARIABILITY OF PRODUCTION

Country	Variability of production	Emergency food aid as a percentage of total food aid	Total food aid as a percentage of production	Food imports as a percentage of production
Angola	21.3	50	9	84
Burundi *	21.8	9	10	4
Benin*	22.6	18	2	19
Burkina Faso*	39.2	25	3	8
Botswana	77.6	13	195	808
Central African Republic	15.9	10	2	17
Chad	20.3	59	8	10
Cameroon*	13.8	21	1	18
Comoros*	20.0	5	19	124
Congo*	35.8	0	10	862
Cape Verde	99.8	77	1,450	219
Ethiopia	34.6	59	9	8
Gambia	27.7	34	10	57
Ghana	23.9	18	7	30
Guinea-Bissau	56.3	50	13	24
Côte d'Ivoire*	23.7	20	1	26
Kenya	32.4	23	2	11
Lesotho*	26.4	6	20	82
Liberia*	22.8	0	0	38
Madagascar	26.4	27	1	10
Mauritius	105.7	2	805	9,530
Mauritania	43.4	54	111	525
Mali	36.8	31	6	13
Malawi	33.5	20	1	2
Mozambique	13.7	68	9	60
Rwanda	21.1	23	3	6
Senegal	29.9	45	10	65
Sierra Leone	12.2	5	2	18
Somalia	42.6	81	29	71
Sudan	48.8	60	6	20
Tanzania	52.8	26	3	8
Togo*	18.4	8	2	19
Uganda	33.9	47	1	3
Zaire	25.7	46	1	35
Zambia	25.1	67	1	23
Zimbabwe	43.8	87	1	6

*These countries are not included in the empirical analysis in the next section.

TABLE 2: GRAIN PRODUCTION AND POPULATION GROWTH, 1970-82

Region	Grain production	Population	Grain production per capita
World	2.3	1.8	0.5
Industrial economies	2.5	0.7	1.6
East Africa	0.8	3.0	-2.2
West Africa	1.9	2.7	-0.8
East Asia and Pacific	3.5	1.7	1.8
South Asia	2.7	2.4	0.3
Latin America	3.2	2.4	0.8

Source: Poverty and Hunger. 1986. Washington, D.C.: World Bank.

Africa's negative growth rates were somewhat offset by an increase in the flow of food aid and food imports (table 1), which add an average 12 and 15 percent, respectively, to total domestic production. Cape Verde, Mauritius, Mauritania, and Somalia depend mainly on food aid; Angola, Congo, Gambia, Mozambique, Senegal, and Zambia primarily on food imports. Observation suggests that countries with a high coefficient of variation of production receive more aid. The simple correlation coefficient between variation of production and food aid is 0.45. This result is even stronger when the ratio of total aid is replaced by emergency aid. It appears that low domestic output triggers donor aid -- mostly emergency help. The same analysis suggests that countries with food shortages tend to import part of the food deficit. In this case the simple correlation coefficient is only 0.25 for total aid, and 0.31 for emergency aid. The next section outlines an approach to the empirical analysis of aid and trade in smoothing food consumption in Africa.

II. THE EMPIRICAL FRAMEWORK

This section describes the relationship between emergency food aid or food imports and transitory changes in domestic production.[2] Since negative shocks to domestic food production are exogenous and are the primary trigger of international emergency food aid, which is endogenous, the potential simultaneous relationship between food aid and food production is not relevant. This is also the case for the effect of transitory output shocks on emergency commercial food

[2] The broader question of the relationship between total financial aid and emergency situations in developing countries, and in Africa in particular, is analyzed in Lavy (1987).

imports. Here, however, negative as well as positive shocks can lead to a change in imports. As a result trade can serve as a symmetric stabilizer (both for positive and negative shocks) of food consumption, while emergency aid is used only as a buffer in the event of food shortages. This trade mechanism works mainly through imports, since food exports are negligible in most African countries.

More formally, let y denote the transitory component of food production, E denote emergency aid, and M denote emergency imports. Based on the above discussion, the response functions have the following form

$$E_t = \begin{cases} \sum_{t=0}^{k} \beta_t y_t + u_t & \text{if} \quad y < \bar{y} \\ 0 & \text{otherwise} \end{cases}$$

and

$$M = \begin{cases} \sum_{t=0}^{k} \tau_t y_t + \epsilon_t & \text{if} \quad y < \bar{y} \\ \sum_{t=0}^{k} \delta_t y_t + \mu_t & \text{if} \quad y > \bar{y} \end{cases}$$

where $\bar{y}$ is a threshold beyond which an output shock will trigger a flow of food aid or a food import response. This threshold is probably different in the two response functions (E and M) and it may vary from country to country. The emergency aid response model can be treated as a limited dependent variable model. More specifically it is a tobit model, with E taking positive or zero

values. Not all the cases in which E has a zero value are directly observed, since the value of E in a given period may reflect a lagged response to previous shocks. So we actually may observe very few cases where E is equal to zero, rendering the estimation of a tobit model impossible. An alternative view of the response model or framework is as a switching regime model. One regime is the case of negative output shocks triggering food aid. The other is for small negative shocks or positive shocks that do not lead to aid flows. Several difficulties arise in estimating such a model. First, since the threshold level is unknown, the switching model is with unknown regimes. Second, the y_t shocks are unobserved and must be estimated. Third, the form of the E and M response functions may be jointly dependent, so that the β's, the τ's, and the δ's should be jointly estimated. Fourth, the lagged response of foreign aid and imports to output shocks may be very important, implying the need to allow for an unrestricted lag structure.

To obtain a measure of the output shocks, an autoregressive model with a time trend for food production is estimated separately for each country. The residuals from these regressions are then used as y_t in the two response functions. In the E_t function a spline is used so that only the negative values of y_t are used to explain the variance of E, while the coefficients on the positive values of y are constrained to be zero. This means that the threshold is constrained to be equal to zero. This approach is preferred over the one that is based on the estimation of a switching model with an unknown threshold, since it allows greater freedom in exploring both the lag structure and the possibility that the β's vary across countries. Some flexibility in the threshold is allowed by introducing nonlinearity in the effect of y on E. It might be expected that

the response for small negative shocks is minimal or even nil, while increasing as y gets larger (but negative). Adopting this approach of making the response directly sensitive to the size of the shock amounts to basically having different β's for different countries (as long as the shocks are of different size). This nonlinearity is explored by adding to the response function the square value of y.

The E and M equations can be estimated jointly, using generalized least squares techniques to investigate the potential correlation of u_t with ϵ_t and μ_t. As long as the set of explanatory variables is not identical in the two equations, efficiency is gained through joint estimation. If the E equation includes only the negative values of $y_t(=y^n)$, while the M equation includes two distinct variables y^n and y^p (positive y values), the above condition is met and the seemingly unrelated estimated is applied.

The crucial variable for the estimation of the model is emergency food aid. This variable is available for 1979-87 for all the Sub-Saharan countries. Given this short time series, a separate estimation for each country is not possible and therefore data were pooled. As noted above the existence of differences in the parameters across countries may be important. Since the response function does not include constants, the fixed effect model is ruled out. The alternative random error component model may be appropriate, though it is difficult to estimate for a system of two equations. Instead, an alternative approach to the fixed effect or the random component model is used that allows the β's to vary according to characteristics of the recipient country. The response functions are therefore augmented with an interaction variable between the y_t's and the z's, which denote country characteristics as detailed below.

Food aid[3] is divided into three categories -- emergency aid, program aid, and project aid. Each of these categories is subdivided into cereal and noncereal aid. All figures are in tons of grain or grain equivalent. Since African data involve large measurement errors, the price and output data must be interpreted with care. The only extended food output and input data available for most of Sub-Saharan Africa is total cereal production. This series is used to estimate random shocks to domestic production and imports. Since several countries received no emergency food aid, or received aid for only a short period, the sample includes those 26 countries that received some emergency food aid for an extended period (see table 1).

III. INTERNATIONAL ALTRUISM: THE EXTENT AND SPEED OF THE RESPONSE

Table 3 estimates the cereal and noncereal emergency food aid response functions. The number of observations is lower than the product of the number of both countries and years because for certain years there are missing values for emergency aid. Each equation included the contemporaneous and three lagged values of the negative as well as the positive shocks of output. The results were not at all sensitive to variations in the specification used to estimate the output shocks. As suggested earlier, positive shocks to output should have no effect on emergency aid. Indeed, the hypotheses that the coefficients of the positive shocks and the constant are equal to zero were accepted at the 5 percent significance level. For example, the F statistic for the hypothesis that all the Y^p variables have zero coefficients is 0.621. Since the tabulated value of

[3] The World Food Program supplied aid data for this study.

$F_{4,117}$ at the 5 percent level of significance is 2.45, the null hypothesis has to be accepted. That is, the evidence suggests that the addition of contemporaneous and lagged positive output shocks, regardless of the lag length, do not contribute to the explanation of variations in current emergency aid flows. The acceptance of zero constants in the equation also means that there is no autonomous level of emergency aid.

Table 4 presents the least-squares best estimate of the aid response function, excluding all the positive shocks. Experiments with various lag patterns and length show that all emergency aid is received over a four-year period from the date of the initial shock. The contemporaneous partial correlation is negative, but not significantly different from zero. The sum of the lag coefficients is equal to -0.45, suggesting that every one-ton reduction in domestic grain production is compensated by almost half a ton of grain in the form of emergency food aid. But most of this -- more than 60 percent -- arrives the year after the negative shock. Some of this lag in response may reflect the sluggish reaction of the donor community. But since the output shocks may be correlated, they could also induce a lagged effect of Y_{t-1} on E_t. For example, if the output shock is caused by a severe drought that forces farmers to leave their farms (temporarily), the following year's crop could also be affected.

Table 5 shows similar data for emergency noncereal aid. Although noncereal flows are marginal, they make up 5 percent of all emergency food and help insulate consumption from extreme random shocks. The timing of the response is similar to that of cereal: most noncereal aid arrives the year after the negative shock.

Before evaluating the effectiveness of aid using the above results, note

TABLE 3: POSITIVE AND NEGATIVE PRODUCTION SHOCKS: ASYMMETRY

	Cereal		Noncereal	
Constant	-783.0 (0.0)	-	532.4 (1.2)	-
Y^p_t	0.027 (0.6)	0.026 (0.6)	-0.001 (0.1)	0.001 (0.1)
Y^p_{t-1}	-0.017 (0.4)	-0.017 (0.4)	0.001 (0.1)	0.001 (0.2)
Y^p_{t-2}	-0.126 (1.9)	-0.126 (1.9)	-0.011 (1.4)	-0.011 (1.4)
Y^p_{t-3}	0.048 (1.5)	0.048 (1.5)	0.003 (0.7)	0.004 (0.9)
Y^n_t	-0.073 (1.5)	-0.073 (1.5)	-0.008 (1.3)	-0.009 (1.5)
Y^n_{t-1}	-0.276 (5.9)	-0.276 (6.0)	-0.026 (4.4)	-0.027 (4.6)
Y^n_{t-2}	-0.037 (0.8)	-0.037 (0.8)	-0.003 (0.5)	-0.003 (0.6)
Y^n_{t-3}	-0.124 (2.7)	-0.124 (2.8)	-0.013 (2.2)	-0.014 (2.4)
R^2	0.387	0.471	0.236	0.362
N	126	126	126	126
F	10.875	15.025	5.826	9.924

Note: Y^p denotes positive output shocks while Y^n denotes negative shocks. t values are in parentheses.

TABLE 4: EMERGENCY FOOD AID: CEREALS

Constant	15223.0 (1.6)	--	5671.8 (0.5)	--	2107.4 (0.2)	--
Y^n_t	-0.031 (1.0)	-0.046 (1.5)	-0.037 (1.2)	-0.043 (1.5)	-0.005 (0.2)	-0.007 (0.2)
Y^n_{t-1}	-0.275 (7.1)	-0.292 (7.8)	-0.253 (6.6)	-0.257 (6.9)	-0.278 (7.1)	-0.280 (7.3)
Y^n_{t-2}	--	--	-0.102 (2.9)	0.109 (3.3)	-0.071 (1.9)	-0.073 (2.0)
Y^n_{t-3}	--	--	--	--	-0.091 (2.2)	-0.092 (2.3)
R^2	0.315	0.40	0.355	0.44	0.374	0.46
N	126	126	126	126	126	126
F					19.7	27.78

Note: t values are in parentheses.

TABLE 5 EMERGENCY FOOD AID: NONCEREALS

Constant	2873.3 (2.5)	--	2052 (1.7)	--	1656.3 (1.4)	--
Y^n_t	-0.006 (1.7)	-0.009 (2.5)	-0.007 (1.9)	0.009 (2.5)	-0.003 (0.8)	-0.005 (1.1)
Y^n_{t-1}	-0.023 (5.0)	0.027 (5.8)	0.029 (4.6)	-0.023 (4.9)	-0.024 (5.0)	-0.026 (5.4)
Y^n_{t-2}	--	--	-0.009 (2.5)	-0.011 (2.8)	-0.005 (1.2)	-0.007 (1.5)
Y^n_{t-3}	--	--	--	--	-0.010 (2.0)	-0.091 (2.2)
R^2	0.204	0.312	0.228	0.350	0.245	0.367
N	126	126	126	126	126	126
F					11.131	19.283

Note: t values are in parentheses.

that there were several missing values of emergency aid. When a missing value was replaced by a zero value, however, the sample size increased, and as expected, the accumulated aid response declined (to 0.35 for cereals and 0.04 for noncereals). For the level of emergency aid, note that the estimates have a threshold level of zero. This implies that every reduction in output, beyond that expected according to the long term-trend, is assumed to trigger emergency aid. In reality, however, emergency aid is provided only when the reduction in output falls beyond a threshold that is less than zero. If this threshold was allowed empirically to be different from zero, the response would be larger than 0.45. Indeed, when the square value of Y was included in the function, some form of this nonlinear response was significant, leading to a higher total response. Similar higher responses were estimated when different -- less than zero -- threshold levels were chosen.

With respect to the sluggishness of the aid mechanism, the difference between the crop year in which output is recorded, and the calendar year in which aid is recorded, implies an overlap; some of the 0.28 response at t-1 really arrived at t. So contrary to criticism, emergency food aid does help insulate domestic food grain consumption from random shocks to domestic production. But the flow of aid that arrives too late may cause a proolem. If the output shock has a short life, the late emergency aid may actually arrive during a period of normal food production, and it may have a negative effect, pushing food prices lower. Our estimate suggests that this "late" flow -- if there is any--is very small, both relative to total aid and to total production, and thus cannot be very harmful.

Random shocks to domestic consumption may also induce a stabilizing

response through changes in imports. The import response can be induced by an increase in domestic food prices relative to prices elsewhere. This mechanism reduces food shortages in a free trade regime. But since many African countries do not have free trade regimes, and imports and food prices are controlled by the government, changes in relative prices are very limited. Table 6 summarizes the parameters of the commercial import response to production shocks. The dependent variable is the deviations, both positive and negative, from the trend of imports derived from the estimation in a first stage for each country. Trade serves as a symmetric buffer: cereal imports fall in good times and rise in bad times. The response is larger and more significant in years of need: over a four-year period imports affect almost 38 percent of any unexpected output drop. The contemporaneous response is nil; most of the compensation occurs in the following year. Again, this reflects to some extent the difference between the calendar year and the crop year.

Trade shipments and aid deliveries compensate countries for 64 percent of the reduction in food within a year after the negative shock. Over four years (excluding coefficients that are not statistically significant), total compensation is about 80 percent. The next section examine some dimensions of the hypothesis that there is discrimination in the response to emergencies.

TABLE 6: TRADE RESPONSE TO EMERGENCY NEEDS: CEREAL IMPORTS

	All imports		Commercial imports	
Constant	-19705.3	--	-22300.4	--
	(2.5)		(2.2)	
Y^p_t	0.001	-0.014	-0.036	-0.052
	(0.0)	(0.4)	(0.8)	(1.2)
Y^p_{t-1}	-0.043	-0.051	-0.011	-0.022
	(1.1)	(1.2)	(0.2)	(0.4)
Y^p_{t-2}	-0.080	0.078	-0.095	-0.095
	(1.5)	(1.5)	(1.4)	(1.4)
Y^p_{t-3}	0.050	0.043	0.027	0.019
	(1.9)	(1.6)	(0.9)	(0.6)
Yn_t	-0.106	-0.091	-0.048	-0.034
	(2.7)	(2.3)	(0.8)	(0.6)
Y^n_{t-1}	-0.170	-0.158	-0.288	-0.274
	(5.0)	(4.6)	(6.0)	(5.6)
Y^n_{t-2}	-0.054	0.047	-0.063	-0.057
	(1.6)	(1.3)	(1.3)	(1.2)
Y^n_{t-3}	0.014	0.026	-0.045	-0.032
	(0.4)	(0.8)	(1.0)	(0.7)
R^2	0.352	0.330	0.424	0.408
N	144	144	126	126

Note: t values are in parentheses.

IV. ECONOMIC AND POLITICAL DETERMINANTS OF GENEROSITY

The global response to these needs for emergency aid varies. The total flow of emergency aid from all donor countries and international organizations may be influenced by political and economic considerations. This section identifies some of the factors that determine the global response to food needs in Sub-Saharan Africa.

The coefficient of response is a function of several factors, z_i, such that

$$y = \Sigma\beta_i y_i + \Sigma\delta y_i z_i + u_i$$

where y_i is the negative shocks to production and the second term is the interaction term that allows the response to vary with z.

The paper tests the following set of hypotheses:

(1) The poorer the country the more generous the response. Country poverty is proxied by per capita income and food consumption.

(2) Donors are more responsive to the needs of countries that already receive large amounts of food aid. This hypothesis is based on the assumption that established food aid flows have organized channels of transmission, making emergency aid more effective and less costly. A related factor is the cost of transportation, which in Africa is mostly a function of the land component of transportation. Inland countries may receive less aid because transportation costs are higher.

(3) The West's response depends on the political orientation of the recipients. The socialist countries include Angola, Benin, Guinea, Mozambique, Ethiopia, and Tanzania. This hypothesis was tested by enlarging this group to

include mixed socialist countries: Madagascar, Rwanda, Sudan, Burkina Faso, Zambia, Congo, Mali, Somalia, and Togo.

(4) The political rights and civil and economic liberties in the recipient country may influence the donor community. Emergency aid may also depend on the form of government. To test these hypotheses, we used Gastil's (1984) ranking of African countries according to political rights, civil liberties, and state of freedom. The first two indices rank countries from one (best) to seven (worse), while the third index characterizes countries as not free, partially free, or fully free. Most countries in Africa are between five and seven. The exceptions are Botswana, Ghana, Mauritius, Nigeria, Senegal, and Zimbabwe. Countries ruled by a military regime are: Togo, Chad, Liberia, Niger, Ghana, Central African Republic, Mauritania, Burkina Faso, and Ethiopia.

Given the large multicollinearity between all these variables, their impact on β had to be estimated one at a time. When the effect was suspected to originate from a correlation with a third variable, that variable was added as a control in the regression. Table 7 summarizes the results of including z as an interaction with the output shocks in the aid equation. The table indicates the sign of the effect and whether it is significantly different from zero at the 5 percent significance level. The first two columns present the results for emergency aid in the form of cereals and noncereals. The signs of the coefficients are the same for the two types of food aid, not surprising given the high correlation between the two. Almost all the coefficients are statistically different from zero and generally they are more precise in the noncereal equation (lower standard errors for the coefficients).

With regard to economic determinants, the hypothesis that the response is

better for poorer countries is accepted for both cereal and noncereal aid. Replacing the GNP per capita measure of poverty with more food-related poverty measures, such as per capita food production or per capita daily cereal consumption, did not produce any significant results. The β_i coefficient varied greatly with the average level (as a share of domestic production) of regular food aid received: countries with a high share of food aid received more aid in crisis situations. If low-income countries tend to receive more nonemergency food aid, however, the correlation between emergency aid and income per capita could be erroneous (given the high collinearity between the two components of food aid). Nevertheless, the income effect in the response equation remained unchanged even when income per capita was controlled for in the estimation. This robust result can be interpreted as follows: The response to emergency needs is correlated positively with the ease (low cost) of delivering food aid, and this cost of transportation and delivery tends to be lower for countries that receive high levels of nonemergency aid. This premise is further supported by the significant contribution of geographical location (inland or on the sea) to the variance of the response to output shocks. The emergency needs of the inland countries do not meet with the same generosity as those with seaports.

A completely different interpretation of the positive partial correlation of β and regular food aid is possible. Emergency food aid is not only an additional food supply, part of it is in fact regular food aid under a different name. This nonadditionality may be more significant in countries that receive more regular food aid. We cannot test this interpretation, nor do we address the related hypothesis that emergency food aid is not additional but is part of nonfood financial aid.

The results for the political and social variables are quite surprising. The international response is not contingent on the form of government or the level of political and human rights violations. On the contrary, countries classified as socialist, with military governments, and a low score in terms of protecting political, economic, and civil liberties, tend to receive more aid (higher β's) in emergency or crisis situations. This tendency is probably a result of the high correlation between some of the other determinants of β and the political and human rights factors. Indeed, socialist countries and countries with restricted political and economic freedoms are at the lower end of the income distribution in Africa. Their β is higher because they are poorer, and the world does not punish them in times of crisis and despair. Regular flows of food aid, however, are highly negatively correlated with socialist or military governments, and poor protection of civil, economic, and political freedoms. This evidence on nondiscrimination may be biased since some countries with severe food crises did not receive any emergency aid and therefore are not included in the sample (for example, Burkina Faso and Congo). The results may therefore suffer from sample selectivity biases.

Table 7 shows the results from reestimating the import response function, but it includes only the negative shocks to output (the positive values were not significant) and their interaction with all z's. Surprisingly, this estimation is almost identical to the aid equation, although it was expected that the market-oriented economies would be more likely to import food for emergency needs. We find just the opposite. The τ's of the nonsocialist countries are higher. This somewhat unexpected result could reflect the fact that the very poor socialist countries finance emergency commercial imports with general financial aid or with balance of payments relief aid.

TABLE 7: FACTORS AFFECTING THE RESPONSE OF AID AND TRADE

	Emergency food aid		Comercial food imports
	Cereal	Noncereal	(Negative shocks)
GNP per capita	(-)*	(-)*	(-)*
Nonemergency food aid Food aid	(+)*	(+)*	(-)*
Access to sea	(+)*	(+)*	(+)*
Socialist	(+)*	(+)*	(+)*
Semi-socialist	(+)	(+)	(+)
Military government	(+)	(+)*	(+)*
Political rights	(+)*	(+)*	(+)*
Civil liberties	(+)*	(+)*	(+)*
Status of freedom	(+)	(+)*	(+)*

* In these cases the interaction term was significantly different from zero (at $\alpha = 0.05$).

Note. (+) means a positive correlation; (-) is negative.

V . CONCLUSIONS

Several studies have interpreted the negative simple correlation between food aid and domestic food production as an indication that food aid has a negative effect on domestic production. This study demonstrates that this correlation is largely due to the response of emergency food aid flows. The dynamics of domestic food production are the exogenous changes that cause and trigger the flow of food aid. So these flows should be treated as endogenous, and they should be netted out from total food aid in an exercise that evaluates the efficiency of food aid.

This analysis of African countries, the major recipients of global food aid, suggests that on average a shock to agricultural output in the form of a one-ton drop in cereal production would lead to a flow of 0.64 tons within a year. Extending the period to four years increases the compensation to 80 percent. This estimate is biased downward, however, since the threshold that was assumed to trigger emergency flows was only zero.

Food aid accounts for about 60 percent of total emergency flows; the rest is in the form of commercial imports. Given that some imports are also aid-financed, the role of aid in alleviating food crises in Africa is very important.

The pattern of aid flows does not provide any evidence of discrimination by donors. Even countries that do not protect human or political rights receive an equal amount of aid during acute food shortages.

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